

High Latitude Meridional Flow on the Sun May Explain North-South Polar Field Asymmetry

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We measured the flows of magnetic elements on the Sun at very high latitudes by analyzing magnetic images from the Helioseismic and Magnetic Imager (HMI) on the NASA Solar Dynamics Observatory (SDO) Mission. Magnetic maps constructed using a fixed, and north-south symmetric, meridional flow profile give weaker than observed polar fields in the North and stronger than observed polar fields in the South during the decline of Cycle 23 and rise of Cycle 24. Our measurements of the meridional flow at high latitudes indicate systematic north-south differences. In the fall of 2010 (when the North Pole was most visible), there was a strong flow in the North while in the spring of 2011 (when the South Pole was most visible) the flow there was weaker. With these results, we have a possible solution to this polar field asymmetry. The weaker flow in the South should keep the polar fields from becoming too strong while the stronger flow in the North should strengthen the field there. In order to gain a better understanding of the Solar Cycle and magnetic flux transport on the Sun, we need further observations and analyses of the Sun's polar regions in general and the polar meridional flow in particular.